

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
24 September 2009 (24.09.2009)

(10) International Publication Number
WO 2009/115816 A2

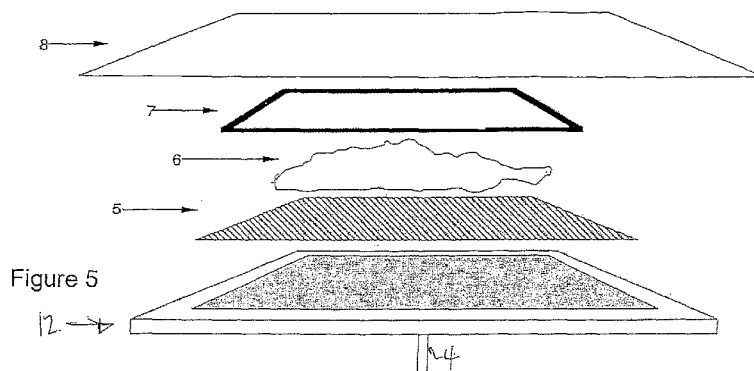
- (51) **International Patent Classification:** Not classified
- (21) **International Application Number:**
PCT/GB2009/000749
- (22) **International Filing Date:**
19 March 2009 (19.03.2009)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
0805074.2 19 March 2008 (19.03.2008) GB
0815433.8 22 August 2008 (22.08.2008) GB
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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,

CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published: — without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) **Title:** MANUFACTURE OF CAST PANELS



(57) **Abstract:** A method of casting flat or relatively flat panels is described. A casting surface is produced by drawing down an elastically deformable film sheet (8) on to a relief structure, which may be unitary or formed of a quantity of configurable material (6) arranged on top of a porous supporting layer(s) in turn supported on the surface of a vacuum table (12). The top of the sheet (8) accordingly adopts a relief configuration defined by the unitary relief structure or by the arrangement of the configurable material (6) underneath it. The configurable material may be granular or particulate, and/or incorporate objects such as letters or pictograms. A castable material, for example fibre reinforced polymeric plaster mix, is then placed on top of the sheet (8) and allowed to set. The edges of the panel are preferably defined by a frame (7).

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MANUFACTURE OF CAST PANELS

This invention relates to the manufacture of cast panels, particularly panels having a relief surface where the relief may take the form of a texture, a
5 graphic design, including lettering and symbols, and combinations thereof.

A classic approach to the manufacture of a relief surface panel is to construct a mould from a pattern which is the shape of the surface desired, apply a layer of castable material to the surface of the mould, cause or allow the castable
10 material to harden or set and then part the set cast material from the mould. This naturally requires the mould not to be re-entrant since otherwise the cast panel would be physically locked to the mould. Even if care is taken in mould manufacture, it is often difficult to separate the two, particularly if the adhesion between the cast material and the surface of the mould is substantial. It is
15 customary to cover the mould surface with some sort of "mould release agent" prior to casting material against it. Separation of the mould and the cast material is easier if the mould is made of silicone rubber, the elasticity and resilience of which enable it easily to be stripped away from the cast material and then re-used. The manufacture of a mould from silicone rubber,
20 however, is not inexpensive, particularly if the panel to be cast is of substantial size such as may be required, for example, for architectural cladding applications.

JP-A-2000-43162 discloses a process for making an architectural panel with a
25 tile-like uneven pattern on its face. A mould with minute suction holes formed inside it is installed in a frame equipped with an air suction device and a plastics film is laid on to the surface of the frame to suck the plastics film down into the mould. Then a crushed stone particle/synthetic resin emulsion is poured into the frame to form the "tiles" followed by a cement mortar and
30 thereafter a rigid foamed plastic hollow block face is placed on top of the cement mortar. Two such structures may be joined back-to-back to provide a

wall section simulating the effect of brickwork.

GB-A-828663 discloses a method of making moulded sheets of glass fibre reinforced polyester resin with a decoratively patterned surface where the
5 originally plain resin sheet is placed on top of a mould surface constituted by a master pattern on to which a flexible foil is held by vacuum. The resin sheet is cured under heat and pressure and optionally a further foil sheet applied over it, and, after curing, the resin sheet with the foil on one or either side constitutes the final panel.

10

Other moulding or mould-forming techniques are described in GB-A-1898/04724 and JP-A-10151610.

According generally to the present invention, there is provided a method of
15 *manufacturing a cast panel with a relief surface which comprises assembling on top of a vacuum table first a porous supporting layer, second one or more relief structures and then an elastically deformable substantially gas-impermeable film over the relief structure, applying suction to draw the film downward towards the surface of the vacuum table and fix the relief*
20 *structure(s) in position, applying a settable moulding composition on top of the drawn-down film, causing or allowing the moulding composition to set or harden, releasing the vacuum, and separating the cast panel from the relief structure and the film.*

25 It is found that working this way, and using a vacuum table as the support for the porous supporting layer and the relief structure, with the elastically deformable film being drawn down by suction on to the relief structure, the surface of the film against which the castable material is cast is very firm, so enabling the castable material to be worked firmly on to its surface without
30 thereby causing any deformation. In contrast, a silicone mould can be deformed during the application of the casting material, and in order to keep

deformation to a minimum it is usually necessary to back the silicone mould with a support, for example of plaster or glass reinforced plastics material. Avoiding this provides a further advantage of the method of the present invention.

5

The use of an elastically deformable film means that, once the pressure differential is removed, the film relaxes, and this promotes easy separation from the underlying relief structure, and easy removal from the cast, set or hardened material of the panel itself.

10

In practising the invention, the elastically deformable film is drawn downwards against the relief structure by actuating the vacuum table. The area of the vacuum table must be larger than the area of the panel to be cast, and the area of the film is preferably larger still. Preferably the film and table are not
15 much larger than the area of the relief structure since this avoids the necessity of sealing the edges of the film to the table, e.g. with adhesive tape, and (if the film is of smaller area than the table) blanking off the periphery of the table, as well as avoiding the extra step of unsealing the edges of the film from the table after casting and before the removal of the casting and film from the relief
20 structure. Preferably the area of the film is sufficient for it to be stretched elastically across the whole vacuum table top, being held simply by friction at its corners.

The relief structure may be a unitary structure, but a major advantage of the
25 casting method of the present invention is that it may also be made out of a plurality of units. These are held in place once the vacuum is applied, but, prior to that, can be moved around at will. The relief structure may thus be formed in one or more sections and from a wide variety of materials. In particular, it may be made from a configurable material, such as a particulate material, or from a
30 number of relief-imparting members, for example letters or numbers, in each case being located on a suitable base. The size of the particles of configurable

material may vary, for example from a sand or powder type of material through to granular materials, or even to large particulate materials, such as gravel or pebbles, or individual items such as marbles, nuts or pasta. A particular configurable material is a set of indicia which can be arranged to enable the production of a cast panel bearing a relief legend. The material may include objects or symbols.

It should be noted that once the suction is applied, configurable granular materials lock up to form a fixed solid structure. This "vacuum locking" has been suggested in the past for holding the shape of a body against which a casting is to be made, for example as disclosed in GB-A-2189183 and DE-A-19740797.

Thus, according to a specific aspect of the present invention, there is provided a method of producing a flat or relatively flat panel of cast material which comprises the following steps:

- placing a layer of porous supporting material on to a generally horizontal vacuum table;
- placing a quantity of configurable material on to the supporting material;
- configuring the configurable material to a desired arrangement and to a desired overall surface shape;
- placing a substantially gas-impermeable film over the configurable material on the vacuum table;
- applying suction to pull the film down against the supporting material and configurable material on the table so as to hold the configurable material in a fixed configuration and provide a relief casting surface;

- applying to the casting surface a quantity of a settable, spreadable moulding composition;
- 5 - causing or allowing the composition to set; and
- separating the set panel from the film against which it was cast.

10 *Preferably the edges of the panel to be cast are defined by the use of an appropriate frame surrounding the quantity of configurable material. The shape of the frame may be varied to suit the desired final panel shape. The depth of the frame is preferably substantially that of the thickness of the final cast panel. The frame may be made up of a number of sections, or may be an integral fixed frame. The frame may also be made up of a configurable*

15 *material such as a flexible rubber strip. The frame may be placed around the configurable material before the application of the elastically deformable film.*

If it is desired to cast a gently curved or even an undulating panel, then the upper surface of the vacuum table may be modified by applying, for example,

20 a layer of sand or similar granular material which is then moved to provide, for example, a shallow curved bed or an undulating bed. It is sometimes of assistance to lay a sheet of permeable material, for example a so-called geotextile sheet, over the sand so as to keep it separate from the configurable material which is then placed on top.

25

The moulding composition which is applied to the casting surface may be chosen from a variety of castable, settable or hardenable compositions. For making rigid panels, the preferred materials are fibre mesh reinforced polymerised plaster mixes. These may be pigmented to provide a panel of the

30 appropriate colour and they may also include a quantity of particulate material such as a fine aggregate to impart a desired texture, for example of stone, to

the final cast panel surface. Fast-setting concrete mixes may also be used. In a further development, a plaster or settable ceramic material or wax may be used to make a panel which is then in turn used as a mould or pattern for a hot casting process, for example having molten metal or hot glass cast against it, or, in the case of wax, used in investment casting. If a settable or curing silicone rubber composition is used as the casting material, the final product may be in the form of a silicone rubber mould.

If desired, appropriate fixing means may be located in the moulding composition so that once the composition has set, the fixing means are firmly embedded within it and may then be used to assist in fixing the panel in the desired position.

The invention is illustrated in the accompanying drawings which show diagrammatically how the method is put into practice. In the drawings:

Figure 1 is a diagrammatic perspective exploded view of a vacuum table for use in the present invention;

Figure 2 is a vertical section through the exploded view;

Figures 3 and 4 a vertical section and perspective view of the assembled table;

Figure 5 is an exploded view diagrammatically showing the items which are sequentially placed on the table;

Figure 6 a diagrammatic perspective view of the material so placed;

Figure 7 shows the addition of the moulding material; and

Figure 8 is a plan view of a cast panel.

Referring to the drawings, a vacuum table 12 consists basically of a flat tray or pan 1 having a depending vacuum port 4 underneath it. Set in the pan 1 is a gas-permeable panel 2 consisting of a geotextile sheet having formed in it an array of conical projections, over the top of which lies a sheet of filter material 3. This arrangement is strongly resistant to vertical compression and does not collapse when vacuum is applied, while the conical array promotes even evacuation of the table. The filter material 3 stops dust passing through into the table and reaching the vacuum pump. Other structures may be used, for example a solid panel with a plurality of air distribution channels underlying a permeable sheet.

Figure 5 shows the sequence of operation. First of all, a porous supporting sheet of geotextile material 5 is placed over filter 3 to prevent fine material penetrating into the table itself. A suitable material is 8 mm thick felted polypropylene fabric, hole-punched to allow the passage of gas or liquid, for example as used in marine defences to prevent erosion.

On top of this, denoted 6, is placed a quantity of configurable material, for example a quantity of pasta shapes.

A rectangular metal frame 7 is shown, the major dimensions of which correspond to those of the intended panel and the thickness of which corresponds to the thickness of the intended cast panel.

Finally, when the configurable material has been moved by hand into an appropriately attractive shape within frame 7, a gas impermeable elastically deformable film 8, for example a sheet of blown 3-layer polyethylene of thickness 25 micron, or a sheet of latex rubber of thickness 60 micron, is draped over the table which it overlaps at 9 and a suction pump then switched

on to exhaust the air from within the table via port 4. This pulls the film 8 down on to the configurable material and holds the entire assembly firmly in place.

Once that has been achieved, a quantity of casting material 10 is simply
5 poured on to the centre of the frame and quickly spread out and e.g. trowelled relatively flat, or it may be sprayed on. The upper surface is going to be the back of the panel and accordingly does not need to be particularly smoothly finished. If it is desired to reinforce the panel, one or more layers of monofilament matting may be dropped into the frame between the application
10 of a first quantity of the casting material and a final quantity. The casting material applied may itself vary, for example starting with an unreinforced gypsum plaster mix to produce a smooth surface finish and finishing with a final backing coat of plaster containing chopped glass fibre - e.g. 12-25 mm long fibres - to provide increased flexural strength to the final cast panel.

15

The vacuum is then maintained to hold everything still while the casting material 10 is allowed to set. After that has occurred, the vacuum is released and the cast panel may then simply be lifted up by raising the film 8. Film 8 may then be pulled away from the front of the cast panel and, as indicated in
20 Figure 8, seen from the front (i.e. seen from the underneath in the casting position) the cast rectangular panel has a textured shape in relief on it. The configurable material 6 may be scooped up for re-use if desired or left in position and a second panel cast in the same way.

25 The present invention is of particular value in casting architectural relief panels, particularly if carried out as a two-stage process. For example, in a first stage, a desired panel design may be laid out on the vacuum table using configurable material, and any relevant relief sections, for example raised letters. The elastically deformable film is laid on top and vacuum applied,
30 whereupon the 'negative' of the front of the panel can be clearly seen. If this is judged by eye to be satisfactory, then a cast panel can be made as described

above. If not, the corner of the film is lifted (even with the vacuum table still operating), adjustments made, and the film replaced, this being repeated until a visually satisfactory result is achieved, after which the first casting may be made. That first cast panel may then be inverted and placed on the table to
5 constitute a relief pattern for the sequential production of a plurality of relief panels, each of which replicates the original relief structure which was constructed on top of the vacuum table in stage 1.

Another valuable application is the manufacture of flat silicone rubber moulds
10 into which materials such as plaster-of-paris may be cast to make ornamental shapes, or into which water may be poured and the mould then placed in a freezer to form novelty "ice cubes".

CLAIMS

1. A method of manufacturing a cast panel with a relief surface which comprises assembling on top of a vacuum table first a porous supporting
5 layer, second one or more relief structures and then an elastically deformable substantially gas-impermeable film over the relief structure, applying suction to draw the film downward towards the surface of the vacuum table and fix the relief structure(s) in position, applying a settable moulding composition on top of the drawn-down film, causing or allowing the moulding composition to set or
10 harden, releasing the vacuum, and separating the cast panel from the relief structure and the film.

2. A method according to Claim 1 wherein the relief structure is formed of a plurality of separate components held in their mutual relative positions by the
15 plastics film while the composition hardens or sets.

3. A method of producing a flat or relatively flat panel of cast material which comprises the following steps:

- 20 - placing a layer of porous supporting material on to a generally horizontal vacuum table;
- placing a quantity of configurable material on to the supporting material;
- 25 - configuring the configurable material to a desired arrangement and to a desired overall surface shape;
- placing a substantially gas-impermeable film over the configurable material on the vacuum table;
- 30 - applying suction to pull the film down against the supporting material

and configurable material on the table so as to hold the configurable material in a fixed configuration and provide a relief casting surface;

5 - applying to the casting surface a quantity of a settable, spreadable moulding composition;

- causing or allowing the composition to set; and

- separating the set panel from the film against which it was cast.

10

4. A method according to Claim 3 and including the step of placing a frame around the quantity of configurable material to define the edges of the cast panel.

15 5. A method according to Claim 3 or 4 and including modifying the surface shape of the upper surface of the vacuum table by applying a layer of sand or similar granular material thereto and moving that material to provide a non-planar bed.

20 6. A method according to Claim 5 wherein a sheet of permeable material is placed over the sand or similar material layer to keep it separate from the configurable material which is then placed on top of that sheet.

25 7. A method according to any one of Claims 1 to 6 wherein the gas impermeable film is a sheet of latex rubber.

8. A method according to any one of Claims 1 to 7 wherein the moulding composition is a fibre reinforced polymerised plaster mix.

30 9. A method according to any one of Claims 1 to 8 wherein the moulding composition is pigmented.

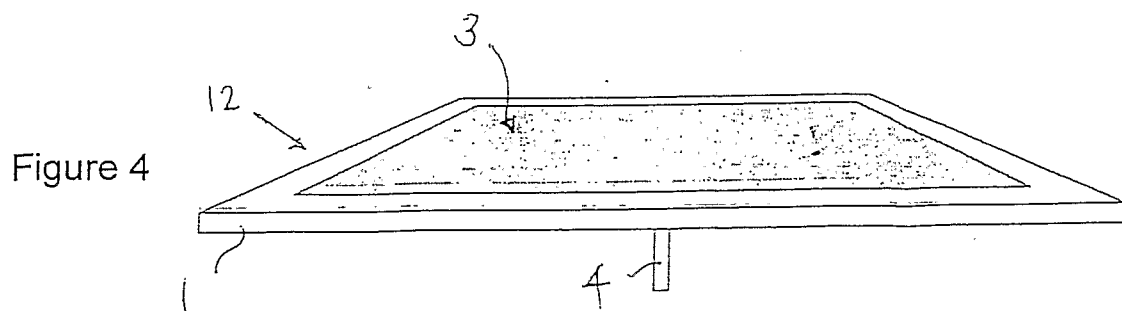
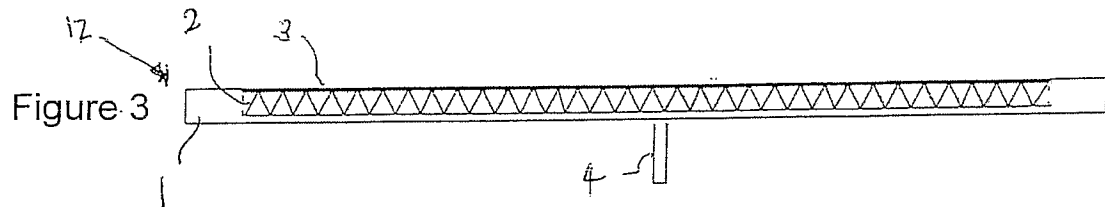
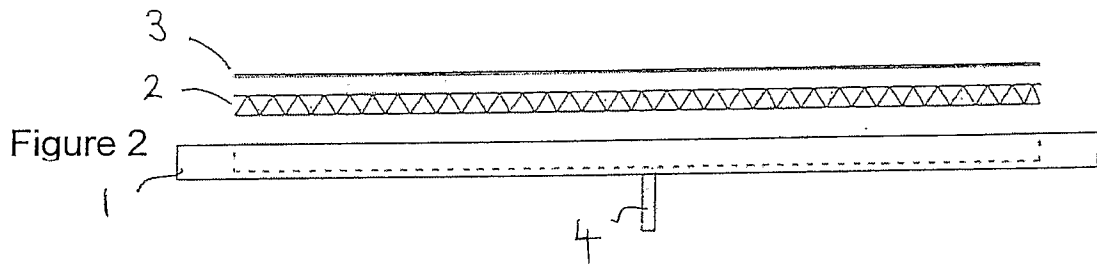
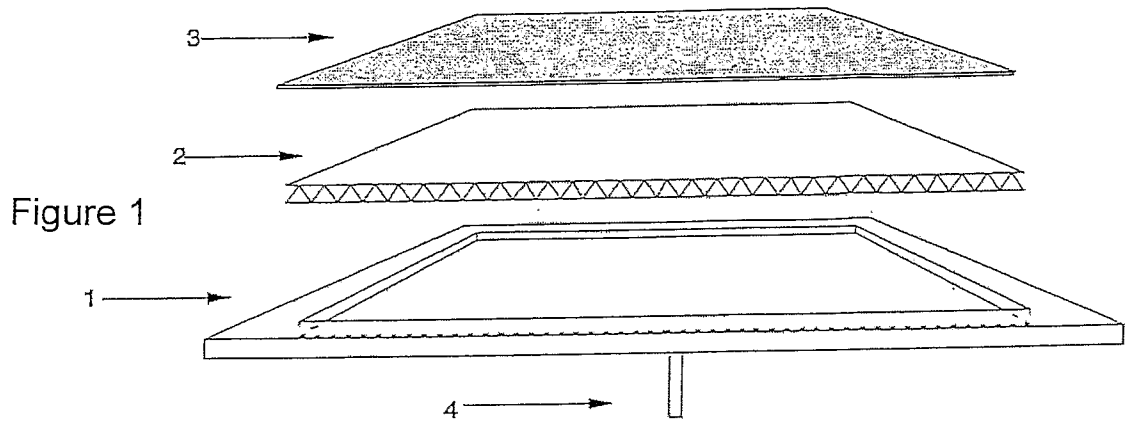
10. A method according to any one of Claims 1 to 9 wherein the moulding composition comprises particulate material to impart a simulated stone or other textured surface in the final cast panel.

5

11. A method according to any one of Claims 1 to 10 and including the step of embedding in the moulding composition, after application to the film but prior to setting, one or more fixing means to assist in fixing the cast panel in a desired position.

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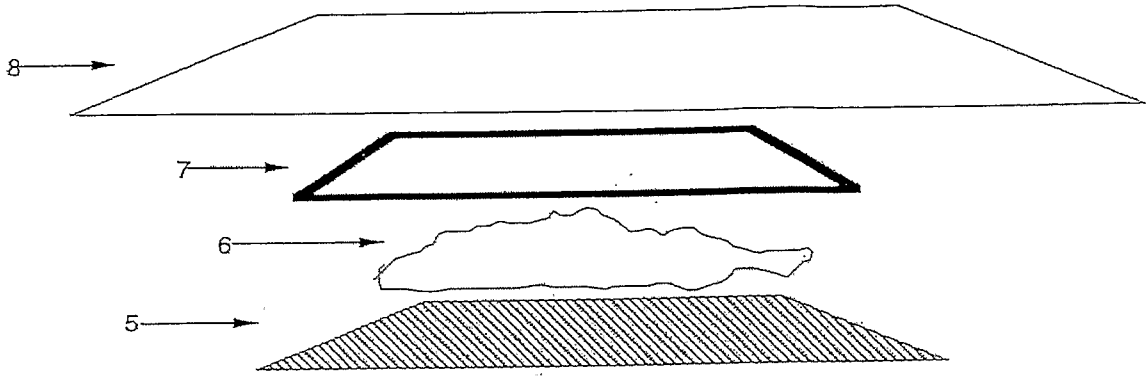


Figure 5

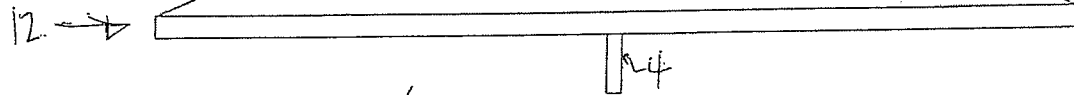


Figure 6

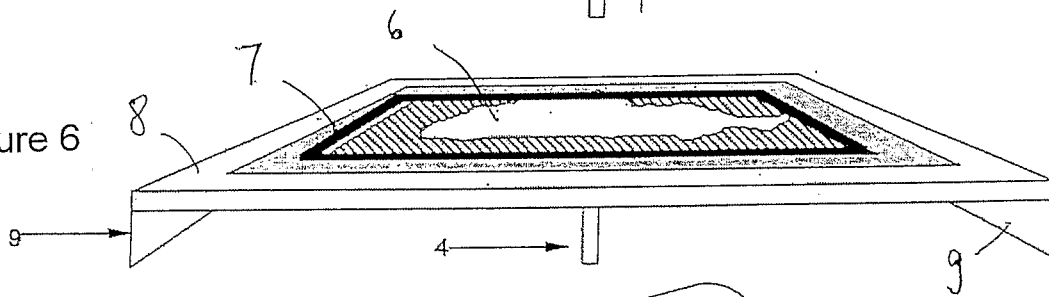


Figure 7

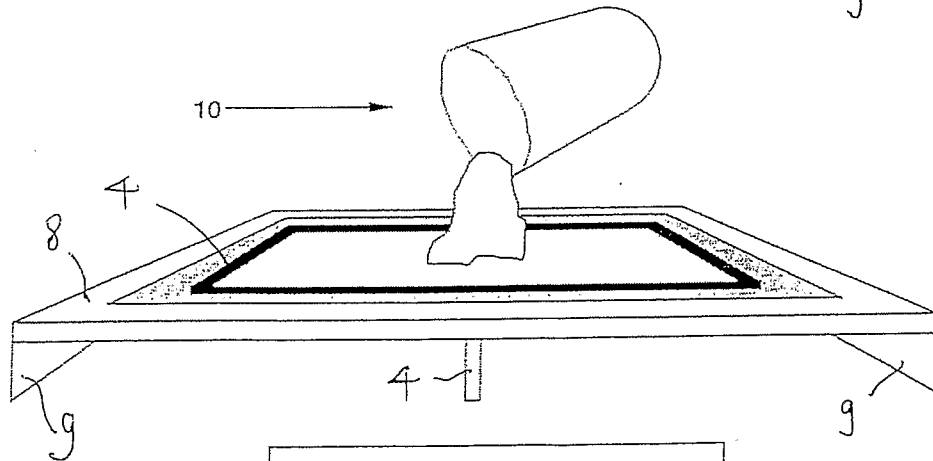


Figure 8

